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EXAMINER	
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ART UNIT	**PAPER NUMBER**
2671	

DATE MAILED: 12/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/757,547	AILA ET AL.	
	Examiner	Art Unit	
	Jason M. Repko	2671	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-18 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-18 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 1/5/04 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 16 (Fig. 1), 210 (Fig. 2), 213 (Fig. 2), and 214 (Fig. 2). Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 9 and 17 are objected to because of the following informalities: Claims 9 and 17 contain typographical errors. Claim 9 is not punctuated by a period. Claim 17 contains a period after "connected" and after "test" in the third line of the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Claim 1 recites the limitation "the first visibility test" in line 4, "the occlusion data" in line 5, "the occlusion culling data" in line 7, and "the second visibility test" in line 10. There is insufficient antecedent basis for these limitations in the claim.

6. Claim 6 recites the limitation "the occlusion buffer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

7. The aforementioned line numbers are given with respect to the first line of the defective claims, as filed on 6/4/2004. The remaining claims are rejected based on their dependence from a defective parent claim.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1-5, 7-12 and 14-18 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,525,726 to Xie et al (herein referred "Xie et al.")

10. With regard to claim 1, Xie et al discloses "a method for testing visibility of graphics primitives, which method comprises the steps of:

a. computing the geometry of graphics primitives (*lines 49-51 of column 4: "In box 40, polygons in a scene are first transformed, clipped, and scaled, as appropriate, in a manner which is understood by those of ordinary skill in the art."*);

b. testing the visibility of the computed primitives in the first visibility test (*lines 60-63 of column 4: "Normally, all polygons in a bin are processed (box 48), although there is an 'early bailout' condition (discussed below) which can cull all remaining polygons in a bin."; lines 61-65 of column 8: "The process also goes to box 132, in an 'early bailout' mode as mentioned earlier, if the nearest Z extent of the bin is further than the furthest Z-buffer value in the tile, indicating that no further polygons in this bin are visible."*);

c. based on said first test storing the occlusion data of the visible primitives for next comparison; and computing the occlusion culling data for each visible primitive (*lines 16-19 of column 5: "If, at box 50, the HZ buffer 100 has not yet been constructed, then the polygon is simply rendered using the Z-buffer (box 54)..."; lines 21-24 of column 5: "Then the HZ buffer 100 is constructed from the Z-buffer. Polygons from subsequent bins undergo the visibility test (box 50) against the HZ buffer before they are rendered."*);

d. characterized in that the method further comprises steps:

i. testing the visibility of the collected primitives in the second visibility test (*lines 64-66 of column 4: "At box 50, if the HZ buffer 100 has already been constructed, each remaining polygon in that bin is tested against the HZ buffer 100."*);

ii. rasterizing visible primitives of the second visibility test *(lines 1-2 of column 5: "Polygons which are determined to be visible, at least partially, by the HZ buffer test, are rendered (box 54)."; lines 4-8 of column 5: "The pixels are shaded, textured, and/or drawn, as appropriate, and they are then scan-converted (box 56) and displayed on the display screen 18 (box 58). In box 60, polygon occlusion statistics are updated.")*.

11. Xie et al does not use the explicit language "collecting stored primitives to an occlusion culling data buffer"; however, one of ordinary skill in the art would recognize that the polygons are stored in a z-buffer analogous to an occlusion culling data buffer from the statement in lines 51-53 of column 13: "...rendering polygons in the scene in depth order, starting with a closest polygon, and storing them in the Z-buffer..."

12. With regard to claim 2, Xie et al discloses "discarding the hidden primitives of the first visibility test" (*lines 66-67 of column 4: "In box 52, any polygons determined to be occluded by the HZ buffer test are discarded."*).

13. With regard to claim 3, Xie et al discloses "storing z values to occlusion fusion cache while computing occlusion" (*lines 16-19 of column 5: "If, at box 50, the HZ buffer 100 has not yet been constructed, then the polygon is simply rendered using the Z-buffer (box 54)..."; lines 21-22 of column 5: "Then the HZ buffer 100 is constructed from the Z-buffer."*). One of ordinary skill in the art would recognize that the HZ buffer 100, taught by Xie et al, is analogous to the occlusion fusion cache recited in claim 3, as the statements on lines 44-50 of column 5 and the equation on line 51 of column 9 show the HZ buffer stores occlusion data computed from the values of the Z-buffer.

14. With regard to claim 4, Xie et al discloses "after said first test collecting occlusion data of the visible primitives belonging to the frame to be rendered to the occlusion culling data buffer" (*120 of FIG. 3B shows rendering to the z-buffer; lines 29-32 of column 2: "The method comprises rendering the polygons in each tile of the scene in depth order, starting with a closest polygon, and storing their pixel depths in the Z-buffer."*). One of ordinary skill in the art at the time of the invention would recognize the polygons in each "tile" are "visible primitives" because said polygons processed in 120 would have passed the first visibility test 108 described in lines 60-63 of column 4 and 61-65 of column 8.

15. With regard to claim 5, Xie et al discloses "after said first test collecting a predefined amount of occlusion data of the primitives to the occlusion culling data buffer" (*lines 34-36 of column 5: "As mentioned above, in addition to dividing the screen into (x,y) tiles as in traditional chunking, each screen tile 19 is further bucket-sorted into bins 22 using a Z (depth) value."; lines 29-32 of column 2: "The method comprises rendering the polygons in each tile of the scene in depth order, starting with a closest polygon, and storing their pixel depths in the Z-buffer."*). One of ordinary skill in the art would recognize from the statements on lines 34-36 of column 5 that the "tile" establishes a predefined amount of data, to be collected by an occlusion culling data buffer.

16. With regard to claim 7, Xie et al discloses "the method further comprises testing visibility of the object before the geometry processor by bounding volume method" (*lines 56-60 of column 5: "For large triangles the bounding box of the exact intersection between polygon and tile is used. The EZ and Ebox of the triangle will eventually be used for testing against the HZ buffer for occlusion."*).

17. With regard to claim 8, Xie et al discloses "testing the visibility of the primitive in the first and the second visibility test with low resolution Z-buffer" (*lines 60-63 of column 4: "Normally, all polygons in a bin are processed (box 48), although there is an 'early bailout' condition (discussed below) which can cull all remaining polygons in a bin."; lines 61-65 of column 8: "The process also goes to box 132, in an 'early bailout' mode as mentioned earlier, if the nearest Z extent of the bin is further than the furthest Z-buffer value in the tile, indicating that no further polygons in this bin are visible."*). One of ordinary skill in the art would recognize that the farthest Z-buffer value is a representative value for a bin, from lines 12-16 of column 13: "For example, one optimization (referred to above as 'early bailout') which can be applied while rendering the polygons for any given tile is to store in the Z-buffer the maximum Z value of any polygon rendered thus far." Therefore, Xie et al does not use the explicit language "low resolution z-buffer"; however, one of ordinary skill in the art would recognize that Xie et al discloses a low resolution z-buffer with a resolution corresponding to the number of tiles for a given image in lines 60-63 of column 4 and lines 61-65 of column 8, wherein the tiles are defined in terms of the image regions as shown in lines 43-36 of column 5. Therefore, the z-buffer as disclosed by Xie et al would be of low resolution with respect to the image. Furthermore, one of ordinary skill in the art would recognize that the HZ buffer used in the second test has multiple levels of resolution, one of which is a low resolution level from the statement in lines 45-48 of column 9: "The HZ buffer 100 shown in the embodiment depicted in FIG. 4 has four levels: an 8-by-8 level 150, a 4-by-4 level 152, a 2-by-2 level 154, and a 1-by-1 level 156, representing the root of the hierarchical Z-buffer tree."

18. With regard to claim 9, Xie et al discloses "a system for testing visibility of graphics primitives (*FIG. 1 shows a graphics system*), which system further comprises:

e. a Geometry processor (*lines 49-51 of column 4, as shown in the rejection of claim 1*);

f. a Z-buffer component (*z-buffer 16 is shown in FIG. 1*);

g. first visibility test module (*lines 60-63 of column 4; lines 61-65 of column 8; as shown in the rejection of claim 1*);

h. occlusion fusion unit (*lines 16-19 of column 5*; *lines 21-22 of column 5; as shown in the rejection of claim 3*);

i. and pixel processing means characterized in that the system further comprises:

iii. an occlusion data buffer (*lines 34-36 of column 5; lines 29-32 of column 2; as shown in the rejection of claim 4*);

iv. and a second visibility test module (*lines 64-66 of column 4, as shown in the rejection of claim 1*)."

19. Xie et al does not use the explicit language "first visibility test module," "occlusion fusion unit," "pixel processing means," and "second visibility test module." One of ordinary skill in the art would recognize that the aforementioned modules are embodied on a integrated circuit 12, from the statement on lines 16-19 of column 4: "In one embodiment the computer software for implementing the AHV functions of the invention is embodied on an integrated circuit comprising at least one processor, such as graphics processor 12."

20. With regard to claim 10, Xie et al discloses "the first visibility test is arranged to discard hidden primitives" (*lines 60-63 of column 4: "Normally, all polygons in a bin are processed (box*

48), although there is an 'early bailout' condition (discussed below) which can cull all remaining polygons in a bin.").

21. Claims 11, 12, 14 and 15 are rejected with the rationale of claims 4, 5, 7 and 3, respectively. Claims 11, 12, 14 and 15 recite limitations similar in scope to those of claims 4, 5, 7 and 3. Claims 11, 12, 14 and 15 are recited as being part of the system recited in parent claim 9, which is shown to be anticipated by Xie et al.

22. With regard to claim 16, Xie et al discloses "the Z-buffer connected to first visibility test module is a low resolution Z-buffer." As shown in the rejection of claim 8, one of ordinary skill in the art would recognize that Xie et al discloses a low resolution z-buffer with a resolution corresponding to the number of tiles for a given image in lines 60-63 of column 4 and lines 61-65 of column 8, wherein the tiles are defined in terms of the image regions as shown in lines 43-36 of column 5. Therefore, the z-buffer as disclosed by Xie et al would be of low resolution with respect to the image.

23. With regard to claim 17, Xie et al discloses "the system further comprises a high resolution Z-buffer connected to said second visibility test." One of ordinary skill in the art would recognize that the HZ buffer used in the second test has multiple levels of resolution, one of which is a high resolution level from the statement in lines 45-48 of column 9: "The HZ buffer 100 shown in the embodiment depicted in FIG. 4 has four levels: an 8-by-8 level 150, a 4-by-4 level 152, a 2-by-2 level 154, and a 1-by-1 level 156, representing the root of the hierarchical Z-buffer tree."

24. With regard to claim 18, Xie et al discloses "the values stored to the low resolution Z-buffer are calculated in occlusion fusion cache." One of ordinary skill in the art would recognize

that the HZ buffer 100, taught by Xie et al, is analogous to the occlusion fusion cache recited in claim 3, as the statements on lines 44-50 of column 5 and the equation on line 51 of column 9 show the HZ buffer stores occlusion data computed from the values of the Z-buffer.

Claim Rejections - 35 USC § 103

25. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

26. Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xie et al in view of U.S. Patent No. 6,720,964 to Fowler et al (herein referred to as "Fowler et al.")

27. With regard to claim 6, Xie et al discloses an "occlusion buffer" (*16 shown in FIG. 1*), as well as the limitations recited in parent claim 1. Xie et al does not disclose compression. Fowler et al discloses "compressing the occlusion buffer" (*lines 12-14 of column 4: "...the compression block 36 attempts to compress the Z data prior to storage in the Z buffer 40"*).

28. With regard to claim 13, Xie et al discloses the limitations of parent claim 9, but does not disclose a compression or decompression means. Fowler et al discloses a system that further comprises "means for compressing and decompressing the occlusion data buffer" (*Figure 1 shows a compression block 36 and a decompression block 38; lines 12-14 of column 4*).

29. Xie et al and Fowler et al are analogous art because they are from similar problem solving area: determining visibility using a z-buffer. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate a compression means as taught

by Fowler et al to compress the occlusion buffer taught by Xie et al. The motivation for doing so would have been to reduce the storage requirements for the buffered data. Therefore, it would have been obvious to combine Xie et al with Fowler to obtain the invention specified in claims 6 and 13.

Conclusion

30. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent No. 6,246,415 to Grossman et al shows an occlusion culling system and method that employs bounding boxes and occlusion buffers. Gernot Schaufler , Julie Dorsey , Xavier Decoret , François X. Sillion, "Conservative Volumetric Visibility with Occluder Fusion," July 2000, Proceedings of the 27th Annual Conference on Computer Graphics and Interactive Techniques, p.229-238 discloses fusing occluding geometry.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The examiner can normally be reached on Monday through Friday 8:30 am -5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JMR

U Chauhan

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER